individual requirements are so varying and manifold that usually only a long series of experiments, differing in each case, can possibly bring about ideal results. Here by the use of agar agar, in itself a simple carbohydrate, taken from seaweed, clinical as well as laboratory experiments have demonstrated the possibility of transforming the hard and dry solidity of the feces into a condition of softer consistency, so that the intestinal contents develop their own agency necessary to produce a healthy, normal evacuation.

My experiments may not be extensive enough to arrive at final conclusions, but the fact that the results obtained are consistent and continuous, unlike the diminishing and aggravating effects of drug treatment, leads us to look for great possibilities from the use of agar agar or similar substances in the treatment of habitual constipation. No claim is made that it will produce permanent cures, but surely no objection from any professional standpoint can be urged against the use of something, harmless in itself, which brings about a condition that approximates natural functions.

THE LOCATION OF THE CARDIAC APEX BEAT.

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The easy recognition of certain auscultatory signs naturally distracts from other methods of physical examination of the heart. The beginner is known by the zeal with which he employs the stethoscope and dwells upon murmurs and rales; unfortunately, many never outgrow this stage, but use auscultation as a short cut to diagnosis. While recognizing the value of auscultation, we should not be led or misled by it and underestimate that of other diagnostic procedures. I desire to call attention to certain points in regard to the so-called apex beat of the heart.

The size and position of the heart are determined by: (1) The location of the apex as ascertained by inspection, palpation, or approximately, when these fail, by auscultation; (2) the area of relative cardiac dulness; (3) orthodiagraphy,[1] or radiography of the heart by a special apparatus, which employs only perpendicular rays, and so does not distort the cardiac outline. In describing the physical signs of the heart, no point is more loosely dealt with than the so-called apex beat. In some of the standard text-books one finds this term applied to the point of maximum visible pulsation in the lower portion of the precordium; in others, to that of maximum intensity of palpable impulse; while a few emphasize the most distant point of pulsation. In the records made by hospital internes one frequently finds noted P. M. I. (point of maximum intensity) so near the median line in a case of cardiac hypertrophy, especially of the right ventricle, as to show that the point mentioned is no indication of the situation of the apex. That many hospital internes seem so devoted to the term "P.M.I." shows that they have either been taught to regard the point of maximum impulse as the important point to localize or have so interpreted their instruction. Having noticed the emphasis laid upon the point of maximum intensity by medical students, hospital internes, and practitioners in New York City, I have investigated this point in all the text-books and manuals of medical and physical diagnosis and diseases of the circulatory system published since 1895, and some of earlier date, and found in the library of the New York Academy of Medicine. The contrast between the views of foreign and of the majority of these American writers is very marked.

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[1] Moritz, Münch. med. Woch., xlvii, 992.

In the text-book of A. L. Loomis,[2] we read: "When from any cause the impulse cannot be seen, its position must be determined by palpation." From this one would infer that seeing an impulse would obviate the necessity for palpation. As the visible impulse of the normal heart is not infrequently produced by a portion of the cardiac wall some distance internal to the apex, the impulse so spoken of is evidently the "point of maximum intensity," and this author, therefore, seems not to lay stress upon the observation of the apex beat as important in determining the size of the heart. That Hare[3] applies the term apex beat to the point of maximum visible pulsation is evident, for, after speaking of the apex beat as located two inches to the left of the sternum, he says: "Displacement to the right is due to adhesions and to hypertrophy and dilatation of the right ventricle, so that the apex beat is felt in the epigastrium or against the edge of the sternum." That, in employing the term apex beat, he refers to the point of maximum intensity is obvious, since in a case of hypertrophy and dilatation of the right ventricle the cardiac apex is really situated farther to the left than in a normal chest. So also Anders[4] says: "The precise apical pulsation may be localized by noting its point of maximum throb." However, he adds: "The extreme left border of the apical impulse in the fifth interspace extends nearly an inch beyond the actual maximum throb of the apex." He thus, emphasizes the manifestation of the site of the portion of the ventricular wall most prominent anteriorly rather than the extent of the ventricle toward the left, which is the important fact to be ascertained, since the situation of the apex beat is sought for in order to determine the extent of the heart toward the left and downward. His second statement, however, seems to show that he recognizes, although he fails to lay the chief emphasis upon, this important point. Da Costa,[5] Le Fevre,[6] and many others omit the term point of maximum intensity. Musser[7] says that a circumscribed area that rhythmically rises and falls is known as the apex beat, although it is a portion of the heart inside the true apex that strikes the chest wall. He makes no mention of the point of maximum intensity, and speaks of other areas of pulsation over the precordia as "new impulses." Butler[8] shows by his definition of the apex beat that he does not lay stress upon the maximum visible pulsation as Hare appears to do. After stating that the apex beat is somewhat internal to the apex formed by the ventricles, and that if there is much hypertrophy the enlarged and rounded heart strikes the chest wall, he adds: "The apex beat should be considered to lie at the point where the finger appreciates a distinct thrust from within." Another work which looks deeper than the visible pulsation is that of Gibson and Russell.[9] These writers say: "The normal apex beat is produced by the impulse of the apex of the left ventricle, but the term apex beat is very loosely applied, often used to denote the part of the precordia where pulsation happens to be most marked. It would seem better if, instead of stating that the apex beat is in such and such a space, it were stated that pulsation is visible in such and such spaces."

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[2] Lessons in Physical Diagnosis, 1899.

[3] Practical Diagnosis, 1907.

[4] Physical Diagnosis, 1907.

The best presentation of the subject in American works is that of R. C. Cabot,[10] who states clearly: "The maximum cardiac impulse is not due to the striking of the apex of the heart against the chest wall, but to the impact of a portion of the right ventricle. The importance of this fact is this: When we are trying to localize the apex of the heart, in order to determine how far the organ extends to the left and downward, it will not do to be guided by the position of the *maximum* impulse, for the apex of the heart is almost always to be found three-fourths of an inch or more farther to the left. This may be proved by percussion. The true position of the cardiac apex thus determined corresponds usually not with the *maximum* impulse, but with the point farthest out and farthest down at which *any rise and fall* synchronous with the heart beat *can be felt.*" It would seem more accurate to modify this statement to read: The point farthest downward and to the left at which a *distinct forward thrust of the heart* can be felt. This excludes the rise and fall of the chest wall, as a whole, which can often be seen and felt beyond the palpable thrust of the apex in cases with a heaving impulse which raises the chest wall. By careful palpation with a proper degree of pressure the limit, to the left, of the clinical cardiac apex can often be distinguished as definitely as the edge of an enlarged spleen, provided it lies in an interspace and not behind a rib. We must acknowledge that the anatomical apex, formed by the tip of the left ventricle, being situated in a plane posterior to that of the right ventricle, comes into direct contact with the thoracic wall only when its apex is situated far enough to the left to strike the lateral wall of the chest.

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[5] Principles and Practice of Physical Diagnosis, 1908.

[6] Physical Diagnosis, 1905.

[7] Medical Diagnosis, 1904.

[8] Diagnostics of Internal Medicine, 1901.

[9] Physical Diagnosis, 1893.

[0] Physical Diagnosis, 1905

Dietlen[11] says that the apex beat is almost always felt one interspace higher than the apex of the silhouette obtained by orthodiagraphy, or if the apex beat is under a rib, at least the width of one rib higher. He explains this by stating that the apex beat is felt in systole, while the silhouette shows the cardiac outline during diastole, and that while the heart changes only slightly in outline during the period of contraction and relaxation, such changes are greatest at the apex. It is the clinical apex, that portion of the heart wall situated normally about three-quarters of an inch internal to the anatomical apex, and the active cause of the palpable apex beat, that is of prime importance, since we must largely rely upon it for determining the size of the heart, orthodiagraphy being unavailable for routine examinations.

In marked contrast with the loose descriptions of some American text-books, apparently copied one from another, are the definitions almost invariably given in the works of German and British writers. Brugsch and Schittenhelm,[12] Ebstein,[13] Geigel,[14] Guttman and F. Klemperer,[15] and G. Klemperer[16] all define the apex beat as the portion of the palpable cardiac impulse situated farthest to the left and downward. As exceptions, we note Sahli,[17] who gives the Delphic definition of the apex beat as the visible and palpable lifting of the chest wall in the region of the apex; Edlefsen,[18] who appears to lay no special stress upon the extent of the heart to the left and downward; and Romberg,[19] who says that in cases with diffuse apex beat the apex is to be considered as situated at the point of strongest pulsation, or, if there is no point of maximum intensity, at the point farthest to the left.

Among the English and Scotch writers, Brown and Ritchie,[20] Sansom,[21] Sawyer,[22] and James MacKenzie[23] state definitely that the apex beat is the lowest and most external point of the cardiac impulse. Poynton[24] emphasizes the idea in these words: "In all cases a note should be made of *the extreme limit to the left* at which the impulse is palpable, and the maximum of the beat not alone relied upon."

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[11] Deutsch. Arch. f. klin. Med., Band lxxxviii, S. 88.

[12] Lehrbuch der klinischer Untersuchungsmethoden, 1908.

[13] Leitfaden der ärztlichen Untersuchung., 1908.

[14] Lehrbuch der klinischen Untersuchungsmethoden, 1895.

[15] Ibid., 1904.

[16] Grundriss der klinischen Diagnostik, 1896.

[17] Lehrbuch der klinischen Untersuchungsmethoden, 1908.

[18] Lehrbuch der Diagnostik der inneren Krankheiten, 1899.

[19] Lehrbuch der Krankheiten des Herzens und der Blutgefässe, 1906.

[20] Medical Diagnosis, 1906.

[21] Diagnosis of Diseases of the Heart and Thoracic Aorta, 1892.

[22] Physical Signs of Diseases of the Thorax and Abdomen, 1908.

[23] Diseases of the Heart, 1908.

Barié[25] lays little stress upon the determination of the situation of the apex beat by palpation, on the ground that inspection is usually sufficient. He considers palpation as indispensable for finding the point of maximum intensity in cases of diffuse apex impulse.

Among the most important recent studies of the heart are those of Moritz,[26] and Dietlen,[27] who particularly oppose the determination of the size of the heart by the position of the apex beat and the left border of relative cardiac dulness, on the ground of their orthodiagraphic observations. They find that these physical signs, as determined by themselves, tend often to indicate a larger heart than really exists. Thus, Moritz[28] says: "By strong percussion one may very easily pass considerably beyond the left border of the heart," and, "the same is true if one uses as the limit of the left border of the heart the outer extremity of the apex beat, especially with vigorously pulsating hearts." (See figure.) Light percussion of the apical region and interpretation of the term apex beat, not as the point of maximum impulse or the most external portion of pulsation of the chest wall, but as the point farthest downward and to the left at which a distinct forward thrust of the heart can be felt, might obviate many of these discrepancies.

The importance of localizing the apex beat by palpation is that it is one of the two easily available methods of determining the extent of the heart to the left, the other, percussion, usually being of great value, but failing in cases with pericardial effusion, and in those in which the adjacent pulmonary resonance is obscured or lost through the presence of pleural thickening or effusion or pulmonary consolidation, through the presence of large breasts, or by the situation of the apex so far to the left, from any cause, that percussion elicits dulness of the lateral surface of the heart to the left of the apex. In such instances definite localization of the apex beat by palpation is of particular value, in the absence of deformities of the thorax, in determining the size of the heart or its displacement, the right border being located by percussion of the relative cardiac dulness. When an apex beat is visible it is usually even more definitely palpable, since firm pressure in an interspace may enable the observer to detect the impact of an apex situated so far from the chest wall as to strike it very lightly, especially during recumbency. In this connection it is important to emphasize the change in the relation of the heart to the chest wall, which occurs in moving from the recumbent to the upright position. The cardiac apex is not only lowered,[29] but the apex, which is carried backward by gravity during recumbency, assumes a position nearer to the chest wall. For this reason palpation of the apex beat for the purpose of ascertaining the position of the apex is often easier when the patient is standing or sitting; occasionally the apex approaches the chest wall sufficiently to be palpable only when the patient bends forward. Percussion of the area of relative dulness must, of course, be performed while in the same position, in order that the outline of dulness, which also varies with change in position, may be considered in connection with the situation of the apex.

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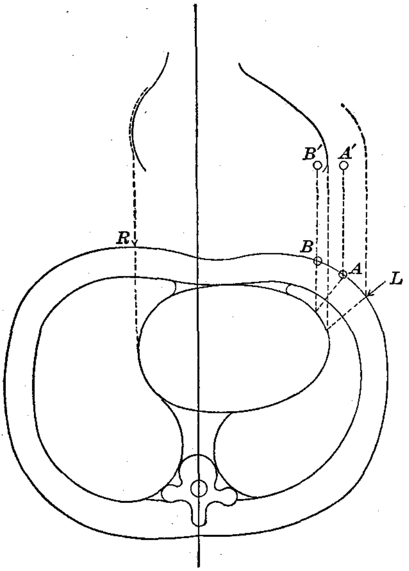
[24] Heart Disease and Thoracic Aneurysm, 1907.

[25] Traité Pratique des Maladies du Cœur et de l'Aorte, 1900.

[26] Deutsch. Arch. f. klin. Med., lxxxi, 1; lxxxii, 1.

[27] Ibid., lxxxviii, 55.

[28] Münch. med. Woch., xlix, 1.



Transverse section of the thorax (diagrammatic) seen from below, with the projection of the true outline of an enlarged heart (Moritz, Münch. med. Woch., xlix). Heavy percussion at *R* and *L* gives the area of dulness indicated by dotted lines in the projection and exaggerates the apparent size of the heart. The impulse felt at *A* and projected at *A′* is confused with the forward thrust of the apex felt at *B* and projected at *B′*, the clinical apex beat.

SUMMARY. The object of locating the clinical apex beat of the heart is to determine the size and position of that organ. The point of maximum impulse frequently does not define the site of the cardiac apex. The point of maximum impulse, either visible or palpable, may be produced by a portion of the heart wall at some distance from the apex. Except in cases in which the visible and palpable impulses coincide, as they usually do with a normal heart, it is better to state simply that pulsation is visible in certain interspaces at a given distance from the median line. It is frequently impossible to determine the left border of the heart by percussion, on account of changes in the resonance of the adjoining area due to large breasts or intrathoracic conditions, or when the apex is carried so far toward the left by hypertrophy or by displacement of the heart, as a whole, that percussion, unless extremely light, tends to bring out dulness of the lateral surface of the heart. Auscultation, as a means of locating the apex, is at best a makeshift in the event of the failure of other methods.

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[29] Moritz, Dietlen, loc cit.

The most valuable clinical method of locating the cardiac apex is the palpation of its impulse when this can be detected in an interspace. The apex beat should be considered as *the point farthest downward and to the left at which a distinct forward thrust of the heart can be felt.* The clinical apex so located, being close to the anatomical apex, is of real value in estimating the size or relative position of the heart. Because of the influence of posture upon the area of relative cardiac dulness, and the situation of the apex beat, it is advisable, for comparison with subsequent observations, to record whether the patient was examined in the erect or in the dorsal recumbent position.

ORTHODIAGRAPHY IN THE STUDY OF THE HEART AND GREAT VESSELS.

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The *x*-rays, as ordinarily used, have proved of distinct value in the study of the intrathoracic vascular system, especially in the detection of aneurysms, but only to a small degree have they aided investigations of the heart itself. The difficulty before the perfection of the orthodiagraph has been the fact that, because of the divergence of the rays, the shadow of the object observed was enlarged. This exaggeration of outline is increased in direct proportion to the nearness of the object to the tube and its distance from the screen upon which the shadow is thrown. Thus, in order to estimate the size of the object under observation, an elaborate system of measurements is necessary, and even then accuracy is extremely difficult.